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METEOROLOGICAL ANALYSIS OF PACIFIC EXPLORATORY MISSION-WEST
EIGHTH SEMI-ANNUAL STATUS REPORT

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for the period 1 October 1994 - 31 March 1995

Principal Investigator: Professor Reginald E. Newell
Massachusetts Institute of Technology
77 Massachusetts Ave., 54-1824
Cambridge, MA 02139

Submitted to: Mr. James M. Hoell, Jr.
ASD M/S 483
National Aeronautics & Space Administration
Langley Research Center
Hampton, VA 23665-5225

By: Professor Reginald E. Newell
Dept. of Earth, Atmospheric & Planetary Sciences
Massachusetts Institute of Technology, 54-1824
77 Massachusetts Avenue
Cambridge, MA 02139
Phone: (617) 253-2940

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During this period we attended the PEM-West (B) Workshop held in Hampton, Virginia, 14-17 November 1994, followed by the PEM-Tropics planning meeting, 18-19 November, at the same place. We also participated in the January 1995 visit to PEM-Tropics sites of Lima, Santiago, Easter Island, Tahiti, and Honolulu, attended the Ad Hoc Meeting concerning PEM-Tropics science goals and ozone stations on February 13, 1995, and attended the meeting at NOAA/NCAR, Boulder on February 20-21, 1995 concerning possible deployment of the WB-57 in PEM-Tropics and future plans for the WB-57. The PEM-Tropics site visit report was circulated on February 10, 1995.

A series of memos was drawn up for the PEM-West (B) mission, and the memos are listed in Appendix A. Memos numbered 1, 2, 3a, 4 and 8 were made available at the workshop. The others are mostly of interest to our group in performing meteorological analyses and have not been circulated. Under the protocol of ECMWF, they require special acknowledgement for any use of these products.

A set of cloud images collected in the field was catalogued and sent down to Langley for reproduction and distribution. A catalogue of the entire image set collected and available at MIT is attached as Appendix B.

Scott Bachmeier, from Langley, visited in October to use our set of images and meteorological charts collected in the field, which are catalogued and stored at MIT, to write a first draft of the meteorological summary for PEM-West (B). This summary will provide text which supplements the data included in MIT's PEM-West (B) Data Memo 1, circulated at the November PEM-West (B) workshop. SSM/I images will be analyzed, and reproduced where relevant, in the next six months.

Two papers were submitted to *Journal of Geophysical Research* for publication in the special PEM-West (A) issue during this period:

On November 4, 1994: Newell, R. E., Z.-X. Wu, W. Hu, E. V. Browell, G. L. Gregory, G. W. Sachse, J. E. Collins, Jr., K. K. Kelly and S. C. Liu, Vertical fine-scale atmospheric structure measured from the NASA DC-8 during PEM West-A.

On January 6, 1995: Newell, R. E., Y. Zhu, E. V. Browell, W. G. Read and J. W. Waters, The Walker circulation and tropical upper tropospheric water vapor.

A third was submitted to *Geophysical Research Letters*: on January 6, 1995, Yeung, K. K., W. L. Chang, R. E. Newell, W. Hu and G. L. Gregory, Tropospheric ozone profiles over Hong Kong. This paper involved a comparison of vertical ozone profiles made by the DC-8 and by the ozonesondes from the Royal Observatory, and the possible reasons for a layer of ozone observed at 3 km.

The papers on Typhoon Mireille, "Atmospheric sampling of super-typhoon Mireille with the NASA DC-8 aircraft on 27 September 1991 during PEM-West (A)," and on cirrus, "Upper tropospheric water vapor and cirrus comparison of DC-8 observations, preliminary UARS MLS measurements and meteorological analyses," were returned to us for changes, resubmitted after revision, and subsequently accepted for publication in *Journal of Geophysical Research*.

The papers, "Vertical fine-scale atmospheric structure..." and "Tropospheric ozone profiles over Hong Kong" are currently being revised.

The paper by Zhu et al., "A new challenge in the calculation of vertical velocity with the kinematic method," has been returned from *JGR* review. It will be considered for resubmission

at a later date as fairly extensive changes are necessary. The paper on the Walker circulation has not yet been returned from the reviewers.

There are still three outstanding manuscripts based on PEM-West (A) data not yet submitted for publication: the "Meteorological Overview" paper, the potential vorticity climatology and the use of Fast Fourier Transforms to study the structure of the boundary layer and the free troposphere. The overview paper was essentially complete at the end of this reporting period and was returned to Scott Bachmeier, the first author, at Langley. The potential vorticity climatology has been expanded and will include PEM-West (B) data. Likewise, for the Fast Fourier Transforms paper, a combined set of PEM-West (A) and (B) data will be included. To date, high time resolution data are not yet available for PEM-West (B). Data for PEM-West (A) have provided an interesting picture whose physics we are trying to unravel.

The major scientific item found during the period was the presence of dry patches in the upper tropical troposphere associated with high potential vorticity. These patches were found when we were comparing the PEM-West (A) and (B) wind fields with the upper tropospheric water vapor from UARS. Some examples were included in the Walker Circulation paper presently under review. This paper also illustrates that transfer in the upper troposphere can occur almost entirely across the Pacific. This was stressed at the PEM-West (B) workshop in November when the concept was used to account for high SO_2 and NO near Hawaii in the upper troposphere, which appeared to originate from the Asian continent.

During the next six month period, we expect to complete the papers noted above, and to prepare papers for the second PEM-West (B) workshop as noted below:

Bachmeier, S., R. E. Newell and Y. Zhu, Meteorological overview of PEM-West (B).

Newell, R. E., Y. Zhu et al., Spectral structure of the boundary layer and comparison with the free troposphere: Influence on trace constituents in PEM-West (A) and PEM-West (B).

Wu, Z.-X., R. E. Newell, E. V. Browell et al., Vertical fine-scale atmospheric structure from the NASA DC-8 during PEM-West (B).

Newell, R. E., S. Bachmeier, E. V. Browell and Y. Zhu, Continental outflow and interaction with clean marine air.

MIT PEM West-B Data Memos

- 1 PEM West-B Maps and Images (2 Volumes)
R. E. Newell, Y. Zhu, Z.-X. Wu, W. Hu, and S. Midlarsky
- 2 Aircraft Videotape Comments, PEM West-B
T. Borzych
- 3a Time Series of CO, Ozone, CH₄, Water Vapor, and Flight Altitude
W. Hu
- 3b Time Series of Ethane, Ethene, Propane, Propene, and Flight Altitude
W. Hu
- 3c Time Series of CO₂, PAN, and C₂CL₄
W. Hu
- 3d Time Series of SO₂, DMS, OCS and Flight Altitude
W. Hu
- 3e Time Series of NO and NOY, and Flight Altitude
Z.-X. Wu
- 3f Time Series of Be-7 and Flight Altitude
W. Hu
- 3g Time Series of CH₃I, Ratios of Propane/Ethane, 1-Butene/Propane, and
Ethyne/CO, and Flight Altitude
W. Hu
- 3h Time Series of Aerosols: 0.35-0.90 Micron Diameter and 0.90-20.0 Micron
Diameter, and Flight Altitude
W. Hu
- 4 Aircraft Winds From Measurements on Aircraft in PEM West-B
Y. Zhu
- 5a Vertical Velocity at 850 hPa from ECMWF Analysis
Y. Zhu
- 5b Vertical Velocity at 200 hPa from ECMWF Analysis
Y. Zhu
- 6a Velocity Potentials and Divergent Winds at 1000 hPa from ECMWF Analysis
Y. Zhu
- 6b Velocity Potentials and Divergent Winds at 500 hPa from ECMWF Analysis
Y. Zhu

- 6c Velocity Potentials and Divergent Winds at 200 hPa from ECMWF Analysis
Y. Zhu
- 7a Stream Function and Rotational Winds at 1000 hPa from ECMWF Analysis
Y. Zhu
- 7b Stream Function and Rotational Winds at 500 hPa from ECMWF Analysis
Y. Zhu
- 7c Stream Function and Rotational Winds at 200 hPa from ECMWF Analysis
Y. Zhu
- 8 Flight Routes
Y. Zhu

PEM-West B Imagery List
(R)

[illegible]

PEM-West B Imagery List
(R)

25-Feb	26-Feb	27-Feb	28-Feb	1-Mar	2-Mar	3-Mar	4-Mar	5-Mar
NOAA11 07:53UTC	GMS-4 IR1 20:32UTC	NOAA11	GMS-4 IR1 20:32	GMS JMH 06Z	GMS-4 IR 00Z	GMS-4 IR 00Z	GMS-4 IR 09Z	GMS-4 IR 12Z
GMS-4 IR 12Z	GMS-4 IR1 08:32UTC	NOAA11 00Z		GMS-4 IR 00Z			GMS-4 VS 07Z	
	GMS-4 IR 00Z	NOAA11 07:36 UTC		GMS-4 IR 12Z			GMS-4 IR 07Z	
	GMS-4 IR 12Z	NOAA11					GMS-4 VS 06Z	
							GMS-4 IR 05Z	
							GMS-4 IR 02Z	
							GMS-4 VS 01Z	
							GMS-4 VS 02Z	
							GMS-4 IR 02Z	
							GMS-4 IR 02Z	
							GMS-4 VS 01Z	
							NOAA11	
							NOAA11 06:30UTC	
							ANAS 00Z	
							GMS-JMH 06Z	
							GMS-4 IR 00Z	
6-Mar	7-Mar	8-Mar	9-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar
GMS-4 VS 00Z	GMS-4 IR 00Z	GMS-4 IR 12Z	GMS 00Z	GMS-4 IR 12Z	? 00Z		GMS-4 IR 12Z	GMS-4 IR 00Z
GMS-4 IR 00Z	Copy of above		GMS-4 IR 00Z		? 00Z			
GMS-4 IR 21Z	GMS-4 IR 06Z				GMS-4 VS 00Z			
GMS JMH 00Z	GMS-4 IR 09Z				GMS-4 VS 04Z			
GMS-4 IR 12Z	GMS JMH 06Z				GMS-4 VS 07Z			
	NOAA11 05:54UTC				GMS-4 IR 00Z			
	Same sta., no time				GMS-4 IR 05Z			
	Iwojima? 18Z				GMS-4 IR 07Z			
	GMS-4 IR 00Z							
	GMS-4 IR 12Z							
In Blue Folder:								
13-Feb	12-Feb	Hong Kong Satellite Images are available for all days of mission.						
GMS-4 VS 07Z	GMS-4 IR 03Z							
GMS-4 VS 04Z	GMS-4 IR 03Z							
GMS-4 VS 00Z	GMS-4 VS 04Z							
GMS-4 IR 00Z								